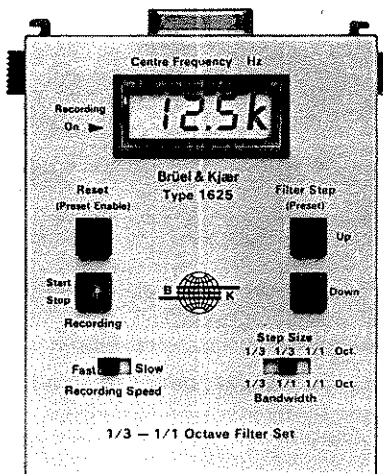


1625

# Instruction Manual

## 1/3 – 1/1 Octave Filter Set Type 1625



A portable Band Pass Filter Set primarily intended for use with Sound Level Meter Type 2230, 2231 or 2233. Permits third-octave frequency analysis, and octave frequency analysis with a step of octave or third-octave. Fully automatic recording of the analysis is possible with a Level Recorder Type 2317, 2306 or Type 2309. The scanning of the filter and the Level Recorder are fully controlled by the Filter Set to obtain an optimal recording. Two scanning speeds are available for analysis of levels measured with "Slow" or "Fast" time weighting.

The selectable centre frequency range is from 20 Hz to 20 kHz and a linear position gives a frequency band from 3 Hz to 75 kHz. The analysed signal may also be weighted by selecting "A" or "C" frequency weightings on the Sound Level Meter.

**$\frac{1}{3}$  –  $\frac{1}{1}$  Octave Filter Set Type 1625**

From serial no. 1032782

Revision May 1985

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## Octave Filter Set and Third Octave/Octave Filter Set

### USES:

- Filter Sets for Sound Level Meters
- Semi-automatic octave noise analysis (Type 1624)
- Automatic 1/3 octave and octave (with 1/1 or 1/3 oct. step) noise analysis (Type 1625)
- Attenuation of background noise
- Distortion measurements
- Loudness evaluation in accordance with ISO R 532 (Stevens and Zwicker)
- Noise checking to octave and third-octave limiting curves
- Building acoustic measurements
- Sound power measurements on machines

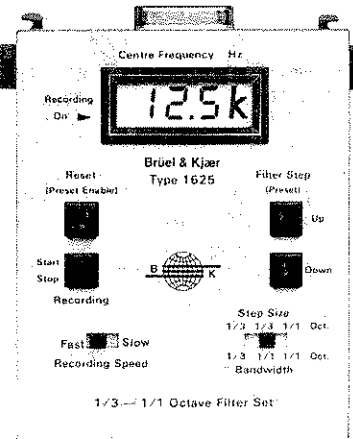
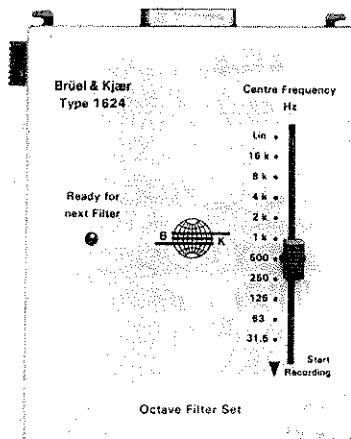
### FEATURES 1624:

- 10 octave filters in accordance with IEC R 225-1966, DIN 45651 and ANSI S1.11-1966 Class II requirements; and unweighted linear response
- Centre frequencies from 31,5Hz to 16kHz, frequency range 22Hz to 22kHz (octave), 5Hz to 75kHz (Lin)
- 0dB nominal filter attenuation

### FEATURES 1625:

- 31 third-octave and 31 overlapping octave filters in accordance with IEC R 225-1966, DIN 45651, DIN 45652, and ANSI S1.11-1966 Class II & III requirements; and unweighted linear response
- Centre frequencies from 20Hz to 20kHz, frequency range 18Hz to 22kHz (1/3 oct.) and 14Hz to 28kHz (oct.), 3Hz to 75kHz (Lin)
- 0dB nominal filter attenuation

Octave Filter Set Type 1624 and Third Octave/Octave Filter Set Type 1625 are primarily designed for use with Sound Level Meters Types 2230, 2231 and 2233 for in situ octave and 1/3 octave acoustic analyses. The Type 1624 enables octave analysis to be carried out, while Type 1625 offers 1/3 octave analysis and octave analysis in octave or 1/3 octave steps. Both filters are compatible with either of the Sound Level Meters, forming a complete, compact and portable, lightweight unit. Semi or fully automatic analysis recording is possible with a portable Level Recorder Type 2317 or 2309.



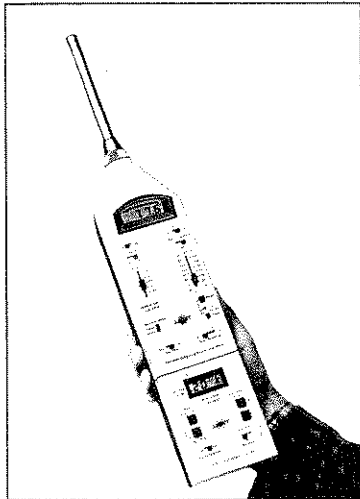


Fig. 1. Sound Level Meter Type 2230 with 1/3-1/1 Octave Filter Set Type 1625

The Octave Filter Set Type 1624 and the Third Octave/Octave Filter Set Type 1625 are both active filters, which are small in size and light weight. Both are easily fitted to the bottom of the Sound Level Meter Type 2230, 2231 or 2233, ensuring both mechanical and electrical connections with proper matching of input and output impedances.

Adding a Filter Set to a Sound Level Meter greatly extends the uses of the instrument, enabling detailed frequency analysis to be carried out.

The overall frequency range of both filters sets covers the entire audio-frequency range with the centre frequencies arranged according to the preferred frequencies of ISO R 266, DIN 45401 and ANSI S 1.6-1960. The filters may be switched in successively manually (Type 1624 or 1625), or automatically (Type 1625). The level in each frequency band is displayed on the Sound Level Meter and may be noted in a measurement report or plotted on graph paper. For greater convenience the analysis can be recorded in situ, either semi-automatically (Type 1624) or automatically (Type 1625) using one of the portable B & K Level Recorders Type 2317 (one channel) or Type 2309 (two channels).

The signal fed to the Filter Set is also weighted as selected on the Sound Level Meter ("A", "C", "Lin. 20 Hz to 20 kHz" or "All Pass 10 Hz to 50 kHz").

#### Octave Filter Set Type 1624

The Type 1624 permits octave frequency analysis when used with a

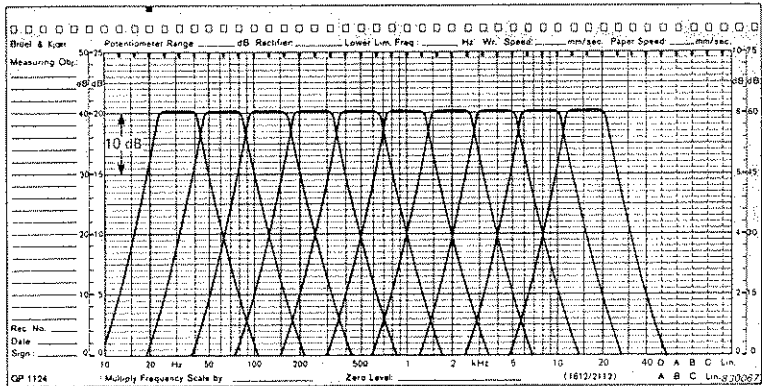


Fig. 3. Frequency characteristics of the 10 octave filters in Type 1624

Sound Level Meter. The analysis can be recorded semi-automatically with the Level Recorder Type 2317 or 2309.

The Type 1624 contains 10 active octave filters with centre frequencies from 31,5 Hz to 16 kHz. Each octave filter satisfies the requirements of IEC Recommendation R 225-1966, DIN 45651 and ANSI S1.11-1966 Class II, see Fig. 2. The total frequency range is from 22 Hz to 22 kHz as can be seen in Fig. 3. A linear position is also available covering the frequency range from 5 Hz to 75 kHz (-1 dB).

For semi-automatic recordings, the Filter Set is connected to the Level Recorder by the control cable AQ 0034. The ground connection is ensured by cable AO 0173 used to connect the Sound Level Meter to the Level Recorder. See Fig. 4. The SPL for the selected frequency band is obtained from the Sound Level Meter Output, and the start/stop of paper movement is controlled by the Filter Set. The recording is made on graduated paper with a scale of 15 mm/octave, such as QP 0124 for Type 2317.

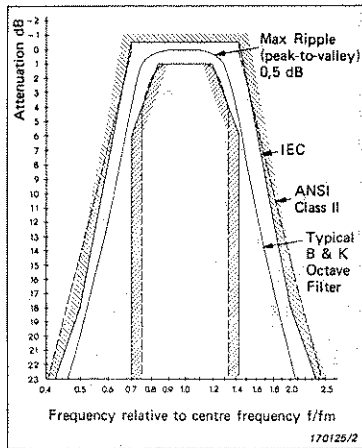


Fig. 2. Top of an octave filter characteristic from the Filter Set Type 1624

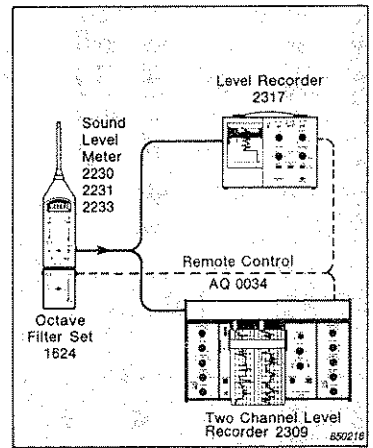


Fig. 4. Set-ups for semi-automatic octave analysis and recording with Type 2317 or 2309

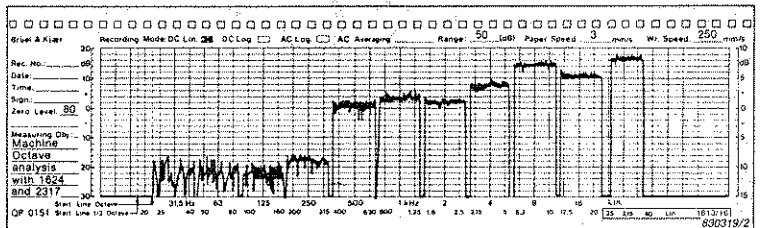


Fig. 5. Octave analysis of machine noise using the set-up in Fig. 4

When recording each octave, the filter output is disconnected from the Sound Level Meter during the first millimetre which corresponds to the settling time. Once the recording of one octave is completed, the paper stops and the indicator READY FOR NEXT FILTER lights up. At the end of the analysis the SPL with the linear weighting (or "A" or "C" if applied on the SLM) is recorded.

### 1/3 - 1/1 Oct. Filter Set Type 1625

The Type 1625 permits 1/3 octave and octave frequency analysis. Octave frequency analysis can be made with octave or 1/3 octave step size. An unweighted frequency response (Lin) from 3 Hz to 75 kHz is also available.

The Type 1625 contains 31 active 1/3 octave filters and 31 overlapping 1/1 octave filters at 1/3 octave intervals covering 11 octaves. Centre frequencies are from 20 Hz to 20 kHz. Each filter fulfils the requirements of IEC recommendation 225-1966, DIN 45 652 and ANSI S1.11-1966 Class III for 1/3 octave filters; and DIN 45 651 and ANSI S1.11-1966 Class II for 1/1 octave filters, see Fig. 6. The total frequency range is from 18 Hz to 22 kHz (1/3 oct.) and from 14 Hz to 28 kHz (1/1 oct.).

The level in each frequency band can be read on the Sound Level Meter's digital display, the centre frequency of the filter being displayed on the Filter Set. The filter centre frequency being selected manually by push button.

When the Filter is connected to a Level Recorder Type 2317 or 2309 the recording of the analysis and the filter stepping is carried out automatically. The Level Recorder is connected to the Sound Level Meter using cable AO 0173, and to the Filter Set using control cable AQ 0034. See Fig. 7.

The filter scanning is electronically programmed and controlled to obtain an RMS read out error less than 0,5 dB over the whole analysis range. The settling time and the paper drive speed are controlled by the Filter Set to ensure a precise recording in a minimum time.

The filter scanning is electronically controlled and programmed to optimise the recording. The Filter Set increases the Level Recorder paper speed as the analysis band centre frequency is increased. Thus, an accurate recording is obtained in a minimum of time.

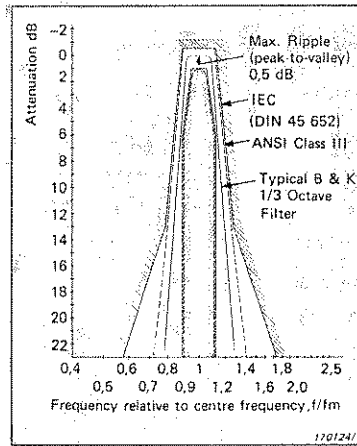


Fig. 6. Top of a 1/3 octave filter characteristic from the Filter Set Type 1625

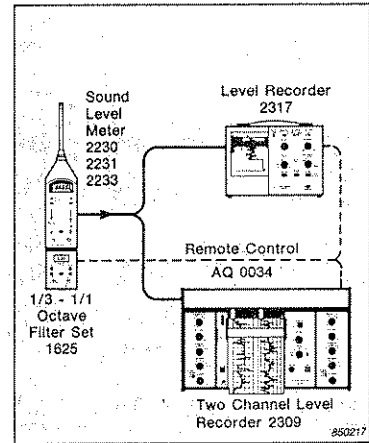


Fig. 7. Automatic 1/3 octave analysis and recording with Type 2317 or 2309

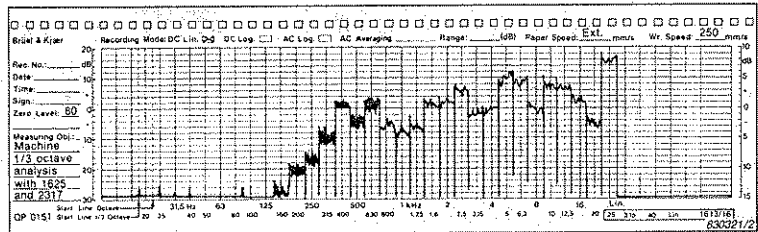


Fig. 8. Third-octave analysis of machine noise using the set-up in Fig. 7

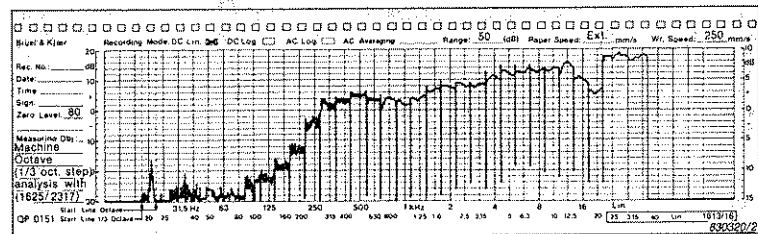


Fig. 9. Octave analysis with 1/3 oct. step size of machine noise using the set-up in Fig. 7

The starting frequency is selectable to eliminate low frequency components and the analysis can be interrupted and restarted during recording with the "Start/Stop" push button. An analysis can also be stopped before completion and the paper automatically moved to the next start position, ready for a new run.

Recording of octave analysis with 1/3 octave or 1/1 octave step size is also automatic. For octave analysis with octave step size, a choice between three series of centre frequencies is offered (lowest frequencies 20, 25 or 31,5 Hz).

Two analysis recording speeds ("Fast" or "Slow") are available to allow for stabilization of the Sound Level Meter detector depending on whether a "Fast" or "Slow" time

weighting is selected on the Sound Level Meter.

### Power supply

The active filters contained in the Filter Sets are powered from the Sound Level Meter through the 15 pin connector, provided the EXT. FILTER switch on the Sound Level Meter is set to "In". The battery pack in the Filter Set contains 4 cells IEC LR 6 (B & K No. QB 0013) and is always connected in parallel with the battery pack in the Sound Level Meter. The battery life (alkaline cells) of the Sound Level Meter/Filter Set is approximately 12 hours with the Type 1624 and approximately 8 hours with the Type 1625. The Mains Power Supply and Charger ZG 0254, including a drawer with rechargeable cells can be used to power the Filter Set.

# Specifications 1624 and 1625

Filter Set Type	1624 Octave	1625 Third-Octave and Octave																		
<b>Frequency Range</b>																				
<b>Selective</b>	22 Hz to 22 kHz	18 Hz to 22 kHz (1/3 oct.), 14 Hz to 28 kHz (1/1 oct.)																		
<b>Linear</b>	Typical 5 Hz to 75 kHz (-1 dB)	Typical 3 Hz to 75 kHz (-1 dB)																		
<b>Band-Pass Filters</b>	10 active 6-pole Butterworth octave filters	31 active 6-pole Butterworth third-octave filters and 31 overlapping 1/1 oct. filters at 1/3 oct. intervals covering 11 octaves																		
<b>In accordance with standard</b>	IEC R 225-1966, DIN 45 651 and ANSI S 1.11-1966, Class II	IEC R 225-1966, DIN 45 652, DIN 45 651 and ANSI S.11-1966, Class II & III																		
<b>Centre Frequencies</b>	31,5 Hz to 16 kHz	20 Hz to 20 kHz																		
<b>Attenuation at Centre Frequency</b>	0 dB ± 0,5 dB	0 dB ± 0,5 dB																		
<b>Peak-to-valley Ripple</b>	< 0,5 dB	< 0,5 dB																		
<b>Attenuation outside Pass Band</b>	See Fig.2 & 3, > 60 dB at 8 f <sub>0</sub> and 1/8 f <sub>0</sub>	See Fig.6, > 75 dB at 5 f <sub>0</sub> and 1/5 f <sub>0</sub> (1/3 oct.) > 60 dB at 8 f <sub>0</sub> and 1/8 f <sub>0</sub> (1/1 oct.)																		
<b>Filter Shift</b>	Slider switch Green lamp indicates time for filter switching when used with Level Recorder	Manual or Automatic with Level Recorder. 1/3 oct. or 1/1 Oct. steps for 1/1 oct. analysis																		
<b>Remote Control</b>	Semi automatic of Level Recorders Types 2317 and 2309 via cable AQ 0034	Automatic to/from Level Recorders Types 2317 and 2309 via cable AQ 0034																		
<b>Input Impedance</b>	10 kΩ in series with 5 μF	10 kΩ in series with 15 μF																		
<b>Input Terminating Impedance</b>	≤ 100 Ω	≤ 100 Ω																		
<b>Input Voltage</b>	Max. 2 V sinus (2,8 V peak)	Max. 2 V sinus (2,8 V peak)																		
<b>Output Impedance</b>	< 5 Ω in series with 15 μF	< 5 Ω in series with 2,2 μF																		
<b>Output Terminating Impedance</b>	≥ 10 kΩ // 1 nF	≥ 10 kΩ // 1 nF																		
<b>Inherent Noise</b>	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">f<sub>0</sub> Hz</td> <td style="text-align: center;">max. μV</td> </tr> <tr> <td style="text-align: center;">31,5 Hz</td> <td style="text-align: center;">200 (typ. 140)</td> </tr> <tr> <td style="text-align: center;">63 Hz - 16 kHz</td> <td style="text-align: center;">150 (typ. 70)</td> </tr> <tr> <td style="text-align: center;">Lin</td> <td style="text-align: center;">250 (typ. 120)</td> </tr> </table>	f <sub>0</sub> Hz	max. μV	31,5 Hz	200 (typ. 140)	63 Hz - 16 kHz	150 (typ. 70)	Lin	250 (typ. 120)	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">f<sub>0</sub> Hz (oct. or 1/3 oct.)</td> <td style="text-align: center;">max. μV</td> </tr> <tr> <td style="text-align: center;">20 Hz - 40 kHz</td> <td style="text-align: center;">250 (typ. 170)</td> </tr> <tr> <td style="text-align: center;">50 Hz - 10 kHz</td> <td style="text-align: center;">150 (typ. 80)</td> </tr> <tr> <td style="text-align: center;">12,5 kHz - 20 kHz</td> <td style="text-align: center;">200 (typ. 110)</td> </tr> <tr> <td style="text-align: center;">Lin</td> <td style="text-align: center;">250 (typ. 120)</td> </tr> </table>	f <sub>0</sub> Hz (oct. or 1/3 oct.)	max. μV	20 Hz - 40 kHz	250 (typ. 170)	50 Hz - 10 kHz	150 (typ. 80)	12,5 kHz - 20 kHz	200 (typ. 110)	Lin	250 (typ. 120)
f <sub>0</sub> Hz	max. μV																			
31,5 Hz	200 (typ. 140)																			
63 Hz - 16 kHz	150 (typ. 70)																			
Lin	250 (typ. 120)																			
f <sub>0</sub> Hz (oct. or 1/3 oct.)	max. μV																			
20 Hz - 40 kHz	250 (typ. 170)																			
50 Hz - 10 kHz	150 (typ. 80)																			
12,5 kHz - 20 kHz	200 (typ. 110)																			
Lin	250 (typ. 120)																			
<b>Magnetic Sensitivity (50 Hz)</b>	Approximately 1 mV output for 100 A/m field strength																			
<b>Operating Temperature</b>	-10 to +50°C (+14 to +122°F)																			
<b>Storage Temperature</b>	-20 to +50°C (-4 to +122°F) Batteries Removed																			
<b>Influence of Temperature on Attenuation</b>	< 0,5 dB (-10 to +50°C)																			
<b>Influence of Humidity on Attenuation</b>	< 0,5 dB for 0 to 90% relative humidity at ≤ 40°C without condensation																			
<b>Batteries</b>	4 × 1,5 V IEC Type LR6 (QB 0013). Batteries used as extra supply for SLM																			
<b>Dimensions</b>	Length 105 mm (4,1 in) - Width 85 mm (3,3 in) - Height 47 mm (1,8 in)																			
<b>Weight</b>	450 g (1 lb) including batteries																			
<b>Accessories Included</b>	4 Alkaline batteries 1 Plug	QB 0013 JP 0802																		
<b>Accessories Available</b>	1,5 m control cable 1,5 m control cable Mains Power Supply and Charger	AQ 0034 AQ 0182 ZG 0254																		

## 2. CONTROLS

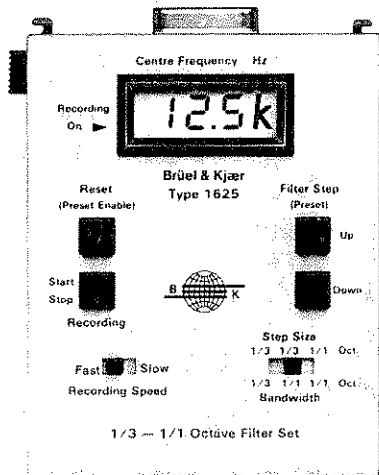


Fig. 2.1. Front view of the Filter Set Type 1625

### RESET (Preset Enable):

Resets the centre frequency of the filter to a preset centre frequency. When connected to a Level Recorder, it actuates the paper drive to move the paper forward to the preset start frequency on the next chart. It also allows setting of the preset centre frequency (see FILTER STEP (preset)).

### RECORDING Start/Stop:

Start/stop push button for the automatic filter scanning and the paper drive on the Level Recorder. The button is operative only if a Level Recorder is connected and switched on. The filter dwell time at each frequency band is programmed to allow optimal recording over the complete frequency range of the analysis.

The analysis can be stopped at any time by momentarily pressing this button, and restarted by pressing it a second time. During this stop, the "Recording On" arrow (see below) stops flashing.

### FILTER STEP (PRESET):

Two push buttons for manually stepping the centre frequency of the  $1/1$  octave or  $1/3$  octave filter.

**"Up"** Shifts the centre frequency one step higher when momentarily pressed. When pressed and held in, the filter steps continuously after a short delay.

**"Down"** Shifts the centre frequency one step lower when momentarily pressed. When pressed and held in, the filter steps continuously after a short delay.



The centre frequencies are from 20 Hz to 20 kHz for both  $\frac{1}{3}$ -octave and octave bands. See Table 3.1 for the  $\frac{1}{3}$  octave and preferred octaves centre frequencies.

When RESET (PRESET ENABLE) is pressed, the preset centre frequency of the Filter Set can be changed using the FILTER STEP (PRESET) "Up" or "Down" push buttons.

**Note:**

— Provided that the batteries produce sufficient voltage for stand-by, both the preset frequency and the centre frequency to which the Filter was set are retained in the memory when the Filter Set is switched off or detached from the Sound Level Meter. To be certain that these two frequencies will be retained, it is recommended to switch EXT. FILTER "Out" before the Sound Level Meter is switched off.

— When the Filter Set is not powered (EXT. FILTER "Out" or Sound Level Meter "Off") all its push buttons are inoperative.

— The Filter is electrically disconnected from the Sound Level Meter while the push buttons are depressed .

**RECORDING SPEED:**

Two position slide switch for adapting the filter sweep speed to the time weighting used on the Sound Level Meter. Set to "Fast" when measuring with the "Fast" time weighting on the Sound Level Meter; and to "Slow" when measuring with the "Slow" time weighting.

Recording Speed	Step Size Bandwidth	$\frac{1}{3}$ Oct. - $\frac{1}{3}$ Oct. (20 Hz - 20 Hz)	$\frac{1}{3}$ Oct. - $\frac{1}{1}$ Oct. (20 Hz - 20 Hz)	$\frac{1}{1}$ Oct. - $\frac{1}{1}$ Oct. (31,5 Hz - 31,5 Hz)
	Fast		3 min. 50 s	2 min. 15 s
Slow		7 min. 40 s	6 min. 10 s	2 min. 50 s

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Table 2.1. Typical time from the beginning of one analysis to the beginning of the next one

**STEP SIZE – BANDWIDTH:**

Three position slide switch for selecting  $\frac{1}{3}$  octave bandwidth ( $\frac{1}{3}$  octave step),  $\frac{1}{1}$  octave bandwidth ( $\frac{1}{3}$  octave step) or  $\frac{1}{1}$  octave bandwidth ( $\frac{1}{1}$  octave step) frequency analysis.

**LIQUID CRYSTAL DISPLAY:**

"Centre Frequency Hz" Digital display indicating the centre frequency of the applied filter.



Fig. 2.2. Centre Frequency display

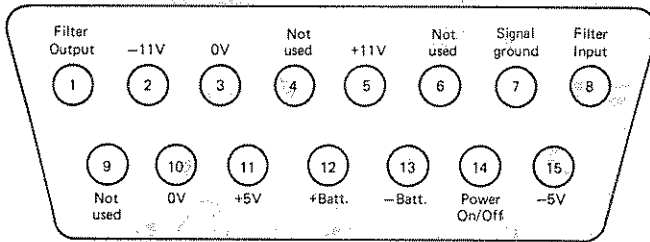
**“Recording On”** For use when connected to a Level Recorder. An arrow on the display flashes quickly when recording a frequency band (recording paper moving) and when the Filter Set controls the Recorder. During the filter settling time (paper not moving) the arrow flashes quickly when RECORDING SPEED is set to “Fast”, and slowly when set to “Slow” to indicate the longer settling time in the “Slow” position.

**Note:**

To avoid shortening the battery life, it is recommended not to switch EXT. FILTER “Off” on the Sound Level Meter while the “Recording On” arrow is displayed.

**CONNECTOR:**

It is possible to externally step the filter to a higher centre frequency at a maximum frequency of 15 Hz, by applying a square wave on pin 3 (alternating open circuit and ground connection) of the RECORDER CONTROL socket (see Fig.2.4). When the “Lin.” setting is reached pin 5 is set to 0 V.



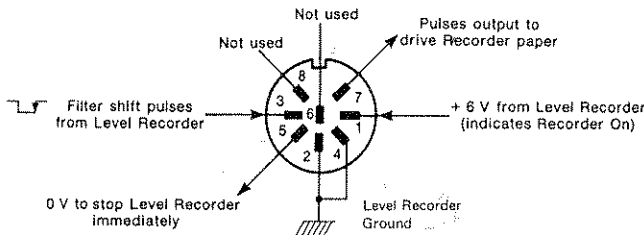
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Fig. 2.3. 15 pin connector for Sound Level Meter Type 2230 or 2233

**RECORDER CONTROL:**

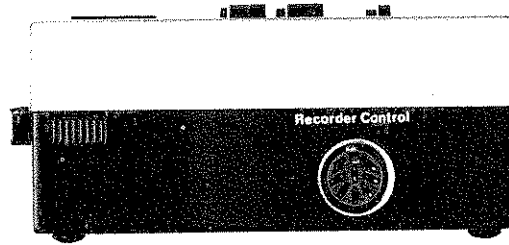
8-pin DIN socket for synchronization of the Filter Set with the Level Recorder Type 2317, 2306 or 2309.

It is possible to externally step the filter to a higher centre frequency at a maximum frequency of 15 Hz, by applying a square wave on pin 3 (alternating open circuit and ground connection) of the RECORDER CONTROL socket (see Fig.2.4). When the “Lin.” setting is reached pin 5 is set to 0 V.



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Fig. 2.4. Recorder Control socket



*Fig. 2.5. Side view of the Filter Set*

**BATTERY DRAWER:**

Battery drawer which accepts four 1,5 V alkaline cells (IEC type LR6, AA size). These are connected in parallel with the batteries in the Sound Level Meter (see section 3.2). This drawer can be replaced by the drawer fitted with rechargeable cells supplied with the Mains Power Supply and Charger ZG 0254 (optional extra).

### 3. OPERATION

#### 3.1. PRELIMINARY

The Type 1625 and the Sound Level Meters Type 2230 or 2233 have matching 15-pin push-fit connectors which facilitate direct coupling of the instruments to form one compact unit. (See Fig.3.1). To attach the Filter Set to the Sound Level Meter, press the two side-locks and engage the connectors. Push the Filter and the Sound Level Meter together gently until the two side locks return to their outer position. (See fig. 3.2.)

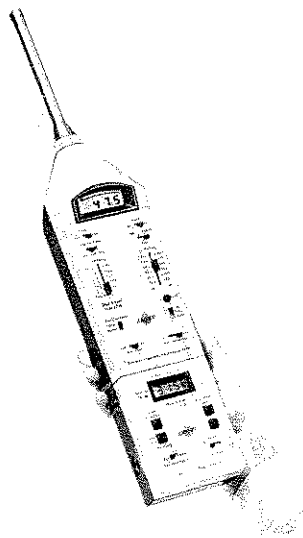


Fig. 3.1. Filter Set with the Sound Level Meter Type 2230

To include the Filter Set in the measurement chain set the EXT. FILTER switch on the Sound Level Meter to "In". The signal measured with the Sound Level Meter is then filtered in an  $\frac{1}{3}$  octave or octave band of centre frequency indicated on the Filter Set digital display. The signal is also frequency weighted as selected on the Sound Level Meter, i.e. "A", "C", "Lin.  $\square$ " or "Lin." (10 Hz to 50 kHz). When no frequency weighting is required, it is recommended that the "Lin." rather than the "Lin.  $\square$ " mode be employed. The SPL for the selected  $\frac{1}{3}$  octave or octave band is displayed on the Sound Level Meter's display.

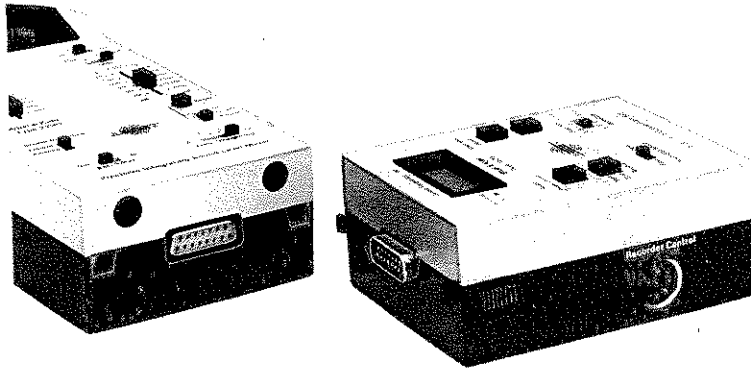


Fig. 3.2. Mounting the Filter Set on the Sound Level Meter Type 2230 or 2233

### 3.2. POWER SUPPLY

#### 3.2.1. Battery Check

The Filter Set is powered via the particular Sound Level Meter connected. The batteries contained in the Filter Set are not used to power the Filter Set directly, but to increase the capacity of the Sound Level Meter's power supply and to retain the preset start frequency and the current centre frequency of the Filter Set when it is switched off or unplugged from the Sound Level Meter. When using with Sound Level Meter Type 2230 or 2233 and alkaline batteries are fitted, the battery life is approximately 10 hours.

To check the battery level of the Filter Set, connect the Filter Set to the Sound Level Meter and remove the battery drawer from the Sound Level Meter. Switch on the Sound Level Meter and note whether a "BAT" sign is indicated on its display. If the "BAT" sign is present approximately half an hour operation time is left (assuming no batteries in the Sound Level Meter). If the "BAT" sign plus a non-resettable "†" appear, the batteries in the Filter Set must be replaced, or recharged if Ni-Cd cells are fitted.

**Note:** One set of batteries, either in the Sound Level Meter or in the Filter Set, is sufficient for powering both instruments. However, the battery life is of course reduced.

For long term storage, it is recommended that the batteries are removed to conserve their life time and as a general safety precaution.

#### 3.2.2. Battery Replacement

Unlock the battery drawer and pull it out. Remove the depleted batteries and place four new ones with polarities as shown in the battery drawer. Push the drawer back into place until the lock is secured. If the "Recording On" arrow flashes when EXT. FILTER switch is set to "In", press RESET on the Filter Set and wait until the arrow stops flashing. The Filter Set can then be preset to the desired centre frequency.

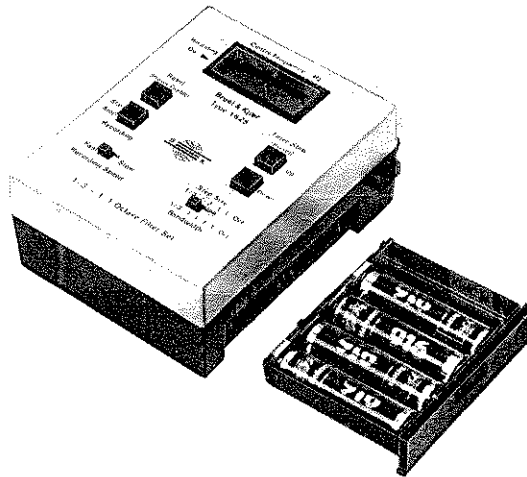


Fig. 3.3. Battery replacement

### 3.2.3. Mains Power Supply and Charger ZG0254 (option)

The battery drawer of the ZG 0254, containing 4 rechargeable cells, fits into the Filter Set Type 1624 and can be recharged either in or outside the instrument via the socket on the side. The Charger delivers enough current for simultaneously powering the Filter Set and Sound Level Meter and recharging the cells to which the charger is attached. When only recharging the cells (drawer pulled out or instrument switched off), a recharging cycle takes approximately 5 hours. When recharging cells while powering the instrument, the recharging time is of course longer.

**Note:** It is not necessary for both battery sets, in the Sound Level Meter and in the Filter Set, to be rechargeable. To avoid confusion, however, only those with rechargeable cells have the socket receiving the charger mounted on the side. If both instruments have rechargeable battery sets, it is necessary to use a separate power supply for each set.

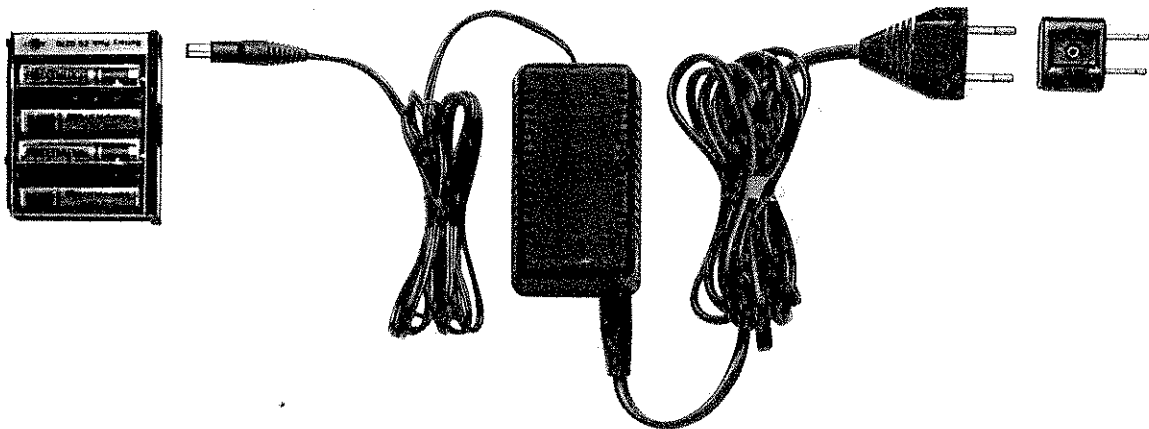


Fig. 3.4. Mains Supply and Charger

### 3.3. FREQUENCY ANALYSIS

In the following sections emphasis is placed on the practical aspects of performing  $1/3$  octave and octave analysis with the 1625. For a comprehensive theoretical understanding of frequency analysis, the book "Application of B & K Equipment to Frequency Analysis" by R. B. Randall should be consulted.

For recordings in AC mode, reference should be made to the Level Recorder Instruction Manual and to the book mentioned above for a proper choice of Recorder Paper Speed and Writing Speed settings.

#### 3.3.1. General measurements

For spot measurements, the SPL in the various frequency bands can simply be read on the Sound Level Meter display. To shift the frequency band manually proceed as follows:

1. Calibrate Sound Level Meter (see Instruction Manual)

2. On the Sound Level Meter set:

POWER:	"On"
REF.-OPERATE:	"Operate"
FSD:	As required
RESET:	"All" or "Max./Min."
FREQ. WEIGHTING:	"Lin.", except if a frequency weighting is to be applied
EXT. FILTER:	"In"
SOUND INCIDENCE:	As appropriate
DISPLAY:	"SPL" ( $L_T$ for Type 2233)
TIME WEIGHTING:	"Fast" or "Slow"
DETECTOR:	"RMS"

3. On the Filter Set:

STEP SIZE - BANDWIDTH:	As required
RECORDING SPEED:	Irrelevant

4. Set the centre frequency required by pressing RESET or FILTER "Up/Down". If FILTER "Up/Down" is kept depressed, the centre frequency starts stepping continuously after a few seconds. The SPL, corresponding to the selected frequency band is displayed on the Sound Level Meter.

**Note:** It is recommended to set EXT. FILTER to "Off" before the Sound Level Meter is switched "Off" to avoid possible erasure of the "Preset Frequency".

#### 3.3.2. Third-Octave Analysis Recording

Fully automatic recording of octave- or  $1/3$ -octave frequency analysis can be obtained using Portable Level Recorders Types 2317, 2306 or 2309 (see Fig.3.5).

Since the Filter Set cannot change the averaging time of the Sound Level Meter, the recording speed is controlled by the Filter Set to obtain an accurate recording in the minimum time. To reduce the fluctuations in the low frequency bands and make interpretation of the recorded signal level easier, the TIME WEIGHTING on the Sound Level

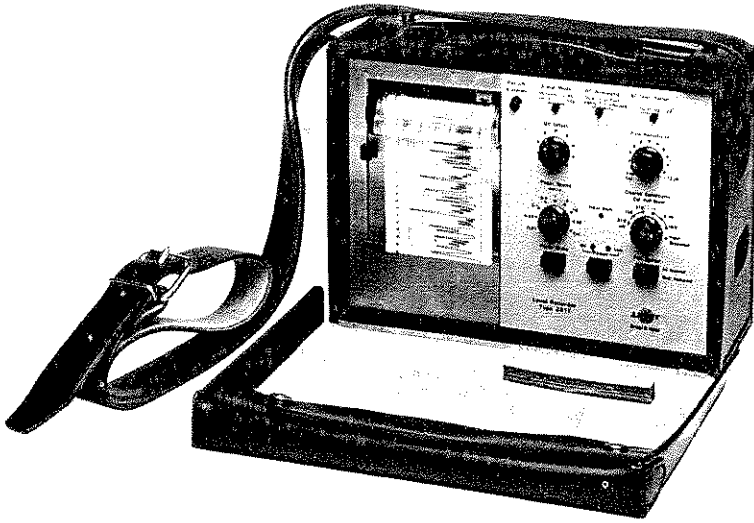


Fig. 3.5. Level Recorder Type 2317

Meter and the RECORDING SPEED on the Filter Set should be set to "Slow". When frequency bands higher than 500 Hz are the main interest, it is recommended to set the Sound Level Meter and the Filter Set to "Fast".

#### Recording with Type 2317

1. Carry out preliminary checks on all 3 instruments (battery level, etc.) and calibrate the Sound Level Meter.
2. Load the Level Recorder with recording paper QP 0124. Connect the Sound Level Meter to Level Recorder using cable AQ 0173, and calibrate the Level Recorder for AC Log or DC Lin (see instruction Manual for Type 2230 and 2317).
3. Fasten the Filter Set to the Sound Level Meter and interconnect the REMOTE CONTROL sockets of the Filter and Level Recorder as shown in Fig.3.5. With earlier Type 2306 Level Recorders use cable AQ 0182 (see section-3.3.4.).

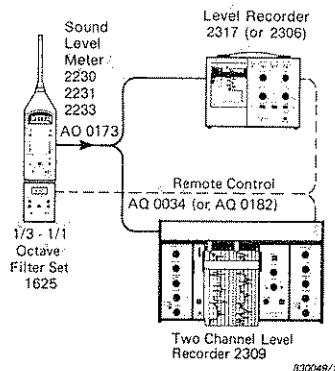


Fig. 3.6. Set-ups for automatic  $1/1$  and  $1/3$  octave analysis and recording with Type 2317 or 2309



4. Set the Sound Level Meter as described in section 3.3.1.

5. Set the controls on the Filter Set as follows:

STEP SIZE-BANDWIDTH:	" $1/3 - 1/3$ "
RECORDING SPEED:	"Slow" or "Fast"; corresponding to the selected TIME WEIGHTING on the Sound Level Meter (DC Lin recordings) or on the Level Recorder (AC Log recordings)

6. Press RESET to display the preset frequency which is always the starting frequency. To change the preset frequency press RESET (Preset Enable), and while keeping it pressed, use the "Up" or "Down" push buttons to step the filter until the desired starting frequency is indicated. When the desired starting frequency is displayed release RESET (Preset Enable).

7. Set the Level Recorder as follows

WRITING SPEED:	"Normal"
PAPER SPEED:	"Ext."
POWER:	On
PAPER DRIVE:	Off
PEN LIFT:	Off

Proceed with recording of the frequency analysis, as outlined at the end of this section.

#### **Recording with Type 2306 (or 2309):**

1. Carry out preliminary checks on all 3 instruments (battery level, etc.) and calibrate the Sound Level Meter.
2. Load the Level Recorder with recording paper QP 0124 (QP 2100 for Type 2309). If the Sound Level Meter is equipped with a DC output, connect this output to the Level Recorder using cable AO 0173 and calibrate the Level Recorder for DC Lin recording (see 2230 and 2306 Instruction Manuals).

If the Sound Level Meter used is the Type 2231, then its AC Output must be used. The Level Recorder must then be calibrated for AC Log recordings, and its WRITING SPEED set to "100 mm/s" (see point 7).

3. Fasten the Filter Set to the Sound Level Meter and interconnect the REMOTE CONTROL sockets of the Filter and Level Recorder as shown in Fig.3.5. With earlier Type 2306 Level Recorders use cable AQ 0182 (see section 3.3.4.).

4. Set the Sound Level Meter as described in section 3.3.1.

5. Set the controls on the Filter Set as follows:

STEP SIZE-BANDWIDTH:	" $1/3 - 1/3$ "
RECORDING SPEED:	"Slow" or "Fast" corresponding to the selected TIME WEIGHTING on the Sound Level Meter. ("Fast" when using Type 2231).

6. Press RESET to display the preset frequency which is always the starting frequency. To change the preset frequency press RESET (Preset Enable), and while keeping it pressed, use the "Up" or "Down" push buttons to step the filter until the desired starting frequency is indicated. When the desired starting frequency is displayed release RESET (Preset Enable).

7. Set the Level Recorder as follows

RECORDING MODE:	"DC Lin"
WRITING SPEED:	"250 mm/s" ("100 mm/s" when using Type 2231)
PAPER SPEED:	"Ext."
POWER:	On
PAPER DRIVE:	Off
PEN DRIVE:	On

Recordings with the Level Recorder Type 2309 are similar to those with the Type 2306.

Proceed with recording of the frequency analysis, as outlined below.

**Recording the frequency analysis:**

Place the recording paper 2,5 mm before the corresponding centre frequency printed on the recording paper, and set PAPER DRIVE on.

Press RECORDING START/STOP to start the automatic recording. The center frequency of the applied  $1/1$  octave or  $1/3$  octave filter is displayed on the Filter Set. When recording is in progress (recording paper moving) the "Recording On" arrow on the display flashes quickly. During the filter settling time (paper not moving) the arrow flashes quickly when RECORDING SPEED is set to "Fast", and slowly when set to "Slow" to indicate the longer settling time.

Each  $1/3$  octave is recorded over 5 mm. At the start of each  $1/3$  octave band recording the Sound Level Meter is disconnected from the filter and the pen moves downwards. This allows time for correct averaging to take place and permits the pen to settle to the correct level after switching from the previous filter. When the "Slow" time weighting is applied to the Sound Level Meter's detector, the RECORDING SPEED on the Filter Set should be set to "Slow" to increase the time allowed for settling.

After the last  $1/3$  octave filter, a Lin (All-pass) filter is recorded. There after the paper moves to the start position on the next chart, ready for a new analysis to be recorded. To repeat a frequency analysis press RECORDING "Start".

To immediately interrupt a frequency recording momentarily press RECORDING "Start/Stop". To resume recording, press the same button a second time. After a delay, the recording is resumed and the last part of the current filter recording is correct.

To stop the recording before completion of the frequency analysis press RECORDING "Stop" and keep it pressed until the pen reaches the bottom line on the paper, and then press RESET before releasing the RECORDING button. However, the time saved is minimal since the analysis time for the high frequency bands is short.

### 3.3.3. Octave Analysis Recording

Automatic Recording of Octave analyses is similar to that used for third octave analysis except for the choice of step size and positioning of the paper. For octave analysis with  $1/1$  oct. or  $1/3$  oct. step size, the STEP SIZE-BANDWIDTH must be set accordingly. The pen must be positioned 2,5 mm before the starting centre frequency on the paper for octave frequency analysis with  $1/3$  oct. step, and 7,5 mm before for octave analysis with  $1/1$  oct. step size.

Centre Frequency Hz	1/3 Oct. B.W. at 3,7 dB Hz approx.	Centre Frequency Hz	1/3 Oct. B.W. at 3,7 dB Hz approx.	Centre Frequency Hz	1/3 Oct. B.W. at 3,7 dB Hz approx.	Centre Frequency Hz	1/3 Oct. B.W. at 3,7 dB Hz approx.
20	4,6	160	37	1,25 k	290	10 k	2300
25	5,8	200	46	1,6 k	370	12,5 k	2900
<b>31,5</b>	<b>7,3</b>	<b>250</b>	<b>58</b>	<b>2 k</b>	<b>460</b>	<b>16 k</b>	<b>3700</b>
40	9,2	315	73	2,5 k	580	20 k	4600
50	11,6	400	92	3,15 k	730	Lin.	-
<b>63</b>	<b>14,5</b>	<b>500</b>	<b>116</b>	<b>4 k</b>	<b>920</b>		
80	18,3	630	145	5 k	1160		
100	23	800	183	6,3 k	1450		
125	29	1 k	230	8 k	1830		

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Table 3.1. Third octave centre frequencies. Bold characters denote preferred series for full octave centre frequencies

To select the series of centre frequencies for octave analysis with octave step size, first switch STEP SIZE to "1/3 Oct." and preset the starting frequency. Then select again a "1/1 oct." STEP SIZE. See Table 3.1.

**Note:** When recording a frequency analysis with the Level Recorder Type 2317, the "Filter Shift" LED will light each 5 mm interval of paper movement.

**Remark:**

The band-edge lines of the recorded analysis may be used, to determine the BANDWIDTH and the STEP SIZE of the recorded analysis as well as the RECORDING SPEED and TIME WEIGHTING used.

1. With a 50 dB range on the Level Recorder, the "Fast" time weighting gives band-edge lines between the bands approximately 32 dB long (See Fig.3.7 or 3.8), while the "Slow" time weighting gives lines 16 dB long (See Fig.3.9).

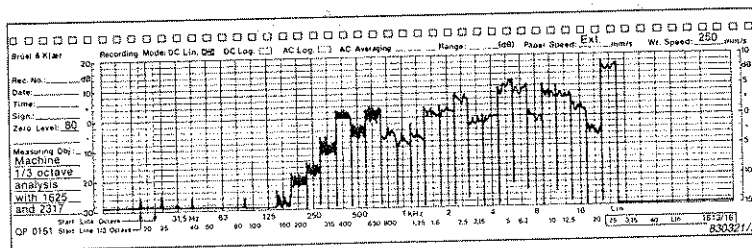


Fig. 3.7. Third Octave analysis on Type 2317

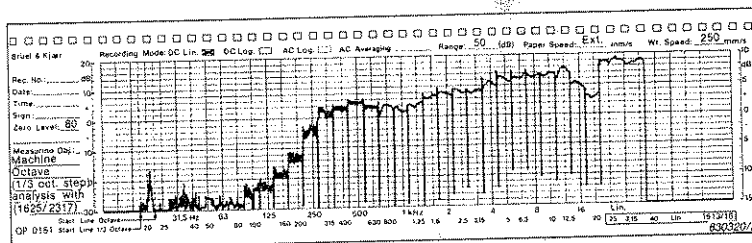


Fig. 3.8. Octave analysis with third octave step size

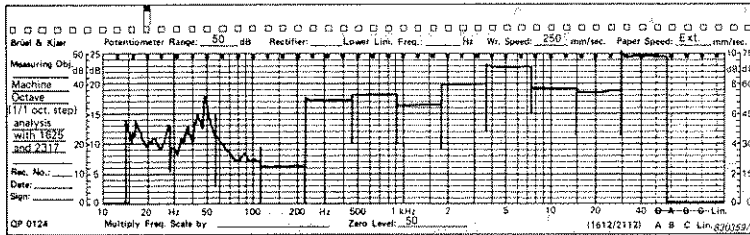


Fig. 3.9. Octave analysis with octave step size

2. A  $1/3$ -octave analysis will give band-edge lines spaced by 5 mm ( $1/3$  oct.) and a "Lin." response 5 mm wide.
3. An  $1/1$  octave analysis with  $1/3$  octave step size will give band-edge lines spaced by 5 mm ( $1/3$ ) and a Lin. response 15 mm wide.
4. An octave analysis with octave step size will give band-edge lines spaced by 15 mm and a "Lin." response 15 mm wide.

### 3.3.4. Frequency Analysis Controlled by Level Recorder

When very low paper speeds are required, it is possible to control the stepping of the Filter Set from the Level Recorder. The recording is then made at constant speed and therefore the recording of the high frequency bands will take much longer than in the previous type of recording.

The recording procedure is as follows:

1. Set the Sound Level Meter as in section 3.3.1
2. Set the controls on the Filter Set as follows:

STEP SIZE-BANDWIDTH:	As required
CENTRE FREQUENCY:	Preset to the starting centre frequency

To preset the starting filter centre frequency, press and hold down RESET, and press FILTER STEP "Up" until the required frequency appears.

3. On the Level Recorder select 15 mm-octave or 5 mm- $1/3$  octave paper drive:

**2317:** Connect pin 8 and 2 on the synchronisation cable AQ 0034 to select 15mm-octave paper drive; and use unmodified synchronisation cable to select 5mm- $1/3$  octave

**2306:** See Fig.3.10 and 2306 Instruction Manual.

4. Set the controls on the Level Recorder as follows:
 

RECORDING MODE:	"DC Lin" (or as required)
WRITING SPEED:	As required
PAPER SPEED:	As required
POWER:	On
PEN DRIVE:	On
PAPER DRIVE:	On

The Recorder starts the filter scanning. When the "Lin." frequency band is reached the paper stops moving.

5. Do **not** set PAPER DRIVE "Off". Position the paper so the pen lies 2 mm before the graduation on the paper corresponding to the starting filter centre frequency for  $1/1$  or  $1/3$  octave analysis in  $1/3$  octave steps. For  $1/1$  octave analysis in  $1/1$  octave steps, position the paper so that the pen lies 7 mm before the appropriate centre frequency graduation.
6. Push RESET button. The Filter steps to the "Preset" centre frequency and the recording starts, the filter scanning being synchronized with the Level Recorder paper drive mechanism. The recording will stop after the last octave or  $1/3$  octave band has been recorded (the "Lin." frequency response is not recorded).

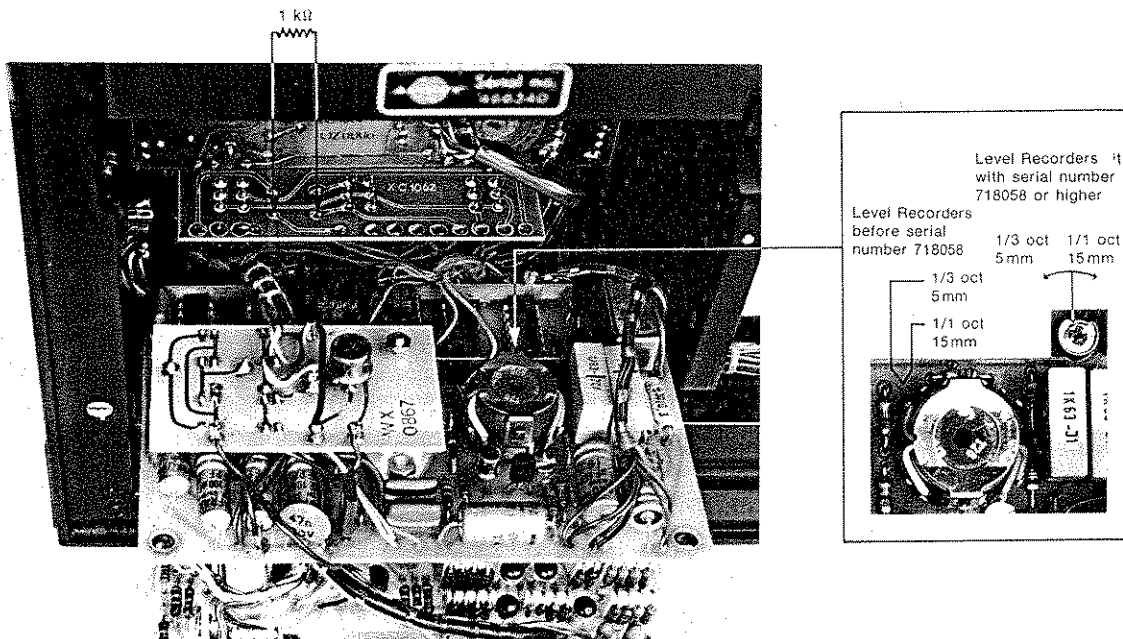
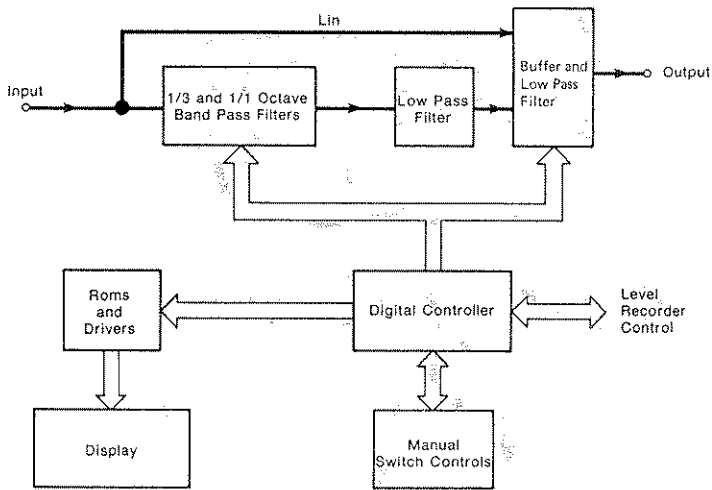


Fig. 3.10. 5mm- $1/3$  octave and 15mm-octave paper drive adjustment with Level Recorder 2306

**Note:**

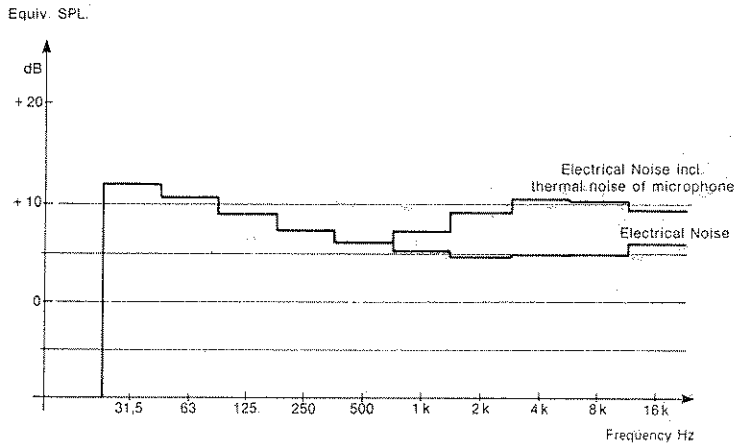
Complete details of synchronisation and use are given in the 2306 (2309) Instruction Manual. It should be noted, however, that Type 2306 Level Recorder before serial number 576700, will have to be modified by connecting a 1 kΩ resistor between the solder points indicated in Fig.3.10, or the Filter Set cannot control the recording.

## 4. APPENDIX



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Fig. 4.1. Block diagram of the 1625 Filter Set



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Fig. 4.2. Inherent noise level of 2230/33 Sound Level Meters with the 1625 Filter Set for octave analysis

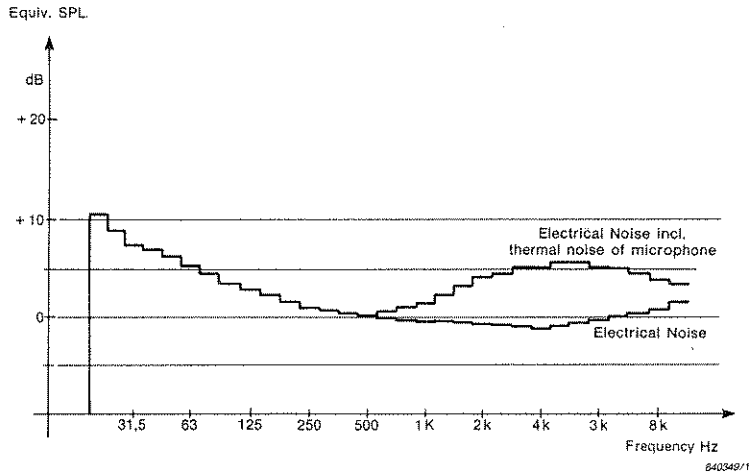


Fig. 4.3. Inherent noise level of 2230/33 Sound Level Meters with the 1625 Filter Set for  $1/3$  octave analysis

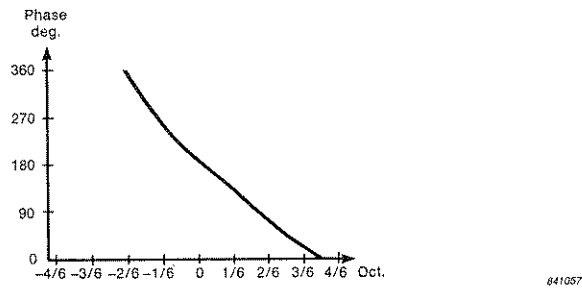


Fig. 4.4. Input/Output phase shift due to the Filter Set (octave band)

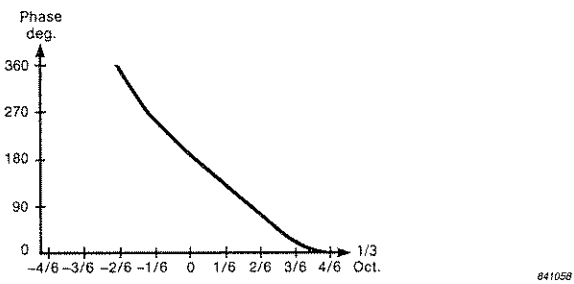
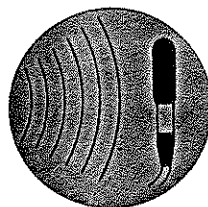
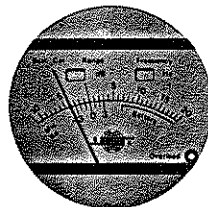
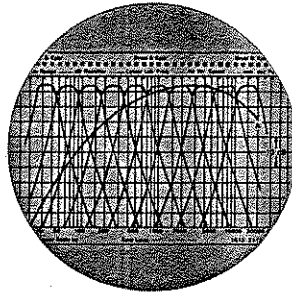
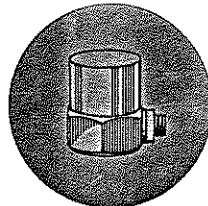
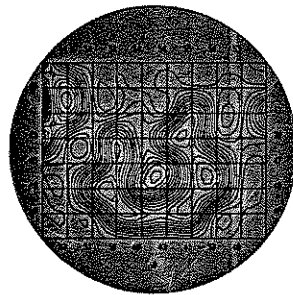
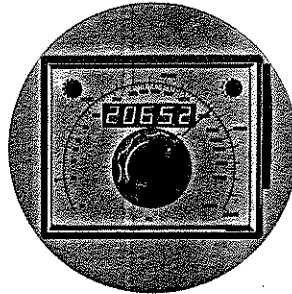
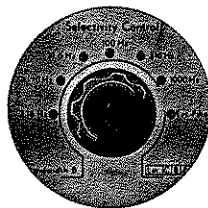
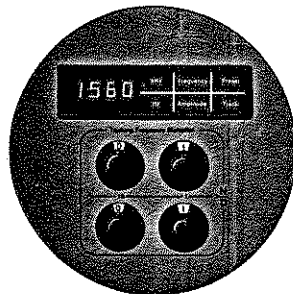
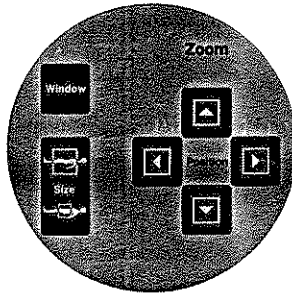
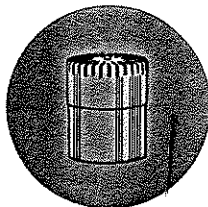
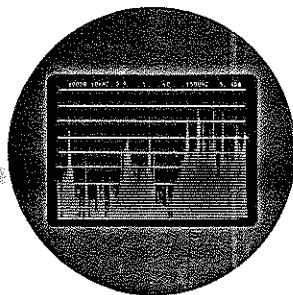
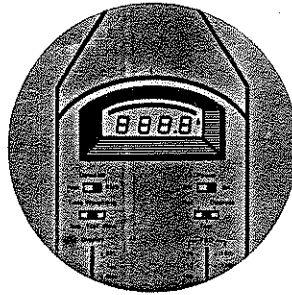
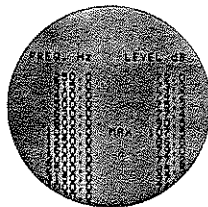
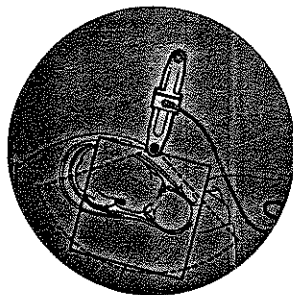
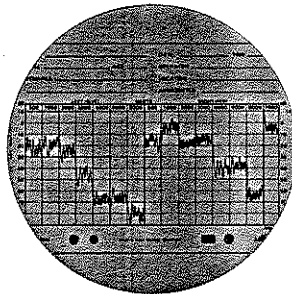
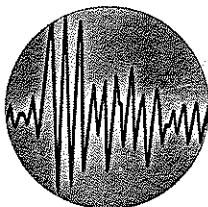
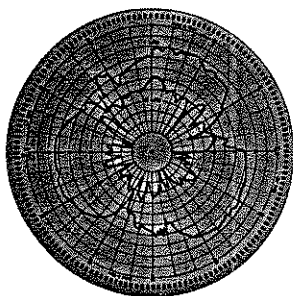


Fig. 4.5. Input/Output phase shift due to the 1625 Filter Set ( $1/3$  octave band)

## **5. SERVICE AND REPAIR**

The Type 1625 is designed and constructed to provide the user with many years of reliable operation. However, should a fault occur which impairs its correct function, then its internal batteries should be removed to prevent risk of further damage. For repair consult the separate Service Instruction Manual available for the Type 1625 or contact your local B & K service representative. Under no circumstances should repair be attempted by persons not qualified in the service of electronic instrumentation.





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